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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Applicant: Amir	Art Unit: 2644
Serial No.: 09/757,012	Examiner: Chan
Filed: January 8, 2001	ARC9-2000-0093-US1
For: SYSTEM AND METHOD FOR MICROPHONE GAIN ADJUST BASED ON SPEAKER ORIENTATION	April 20, 2004 750 B STREET, Suite 3120 San Diego, CA 92101

DECLARATION UNDER RULE 131

Commissioner of Patents and Trademarks
Washington, DC 20231

Dear Sir:

I, Arnon Amir, declare as follows:

I am one of the original inventors of the invention claimed in the above-captioned application.

As evidenced by the enclosed IBM Invention Disclosure form dated as being created on March 28, 2000 and modified on April 5, 2000, I and my co-inventor conceived of the present invention at least prior to December 4, 2000. Specifically, using the limitations of Claims 1 and 6 as an example and referring to the enclosed document, we conceived of a a computer-implemented method for generating a gain adjust signal to establish an audio output level that includes receiving a person-microphone position signal which represents a position of a person relative to a microphone (page 2, paragragp number 2, last sentence). The method we conceived also includes determining a gain adjust signal based at least in part on the person-microphone position signal (id.), and using the gain adjust signal to establish the audio output level (page 3, Figure 1). In our conception, the person-

microphone position signal can be derived from a motion sensing system or a position sensing system or an orientation sensing system or a distance sensing system (third page of enclosed document, labelled "page 4", bottom of page). The disclosure also teaches several additional features of one or more dependent claims.

I declare that we were diligent in reducing the invention to practice at least from a time prior to December 4, 2000. Specifically, I declare that we submitted the enclosed invention disclosure prior to December 4, 2000 to IBM Intellectual Property Department, which then diligently processed the application for disclosure to outside counsel and subsequent filing within the usual course of IBM business in filing patent applications.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United State Code and that such willful, false statements may jeopardize the validity of the application or any patent issued thereon.

Arnon Amir

BY: ARNON AMIR
date: 4/20/2004

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Respectfully submitted,

John L. Rogitz
Registration No. 33,549
Attorney of Record
750 B Street, Suite 3120
San Diego, CA 92101
Telephone: (619) 338-8075

JLR:jg

Disclosure ARC8-2000-0148

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Required fields are marked with the asterisk (*) and must be filled in to complete the form.

Summary

Status	Under Evaluation
Processing Location	ARC
Functional Area	K57 - Cyberspace Technology & Application - (N. Pass)
Attorney/Patent Professional	Alison Mortinger/Almaden/IBM
IDT Team	Alison Mortinger/Almaden/IBM; Susana Delgado/Almaden/IBM
Submitted Date	03/29/2000 08:00:11 PM
Owning Division	Add/Change
PVT Score	To calculate a PVT score, use the 'Calculate PVT' button.
Incentive Program	
Lab	
Technology Code	

Inventors with Lotus Notes IDs

Inventors: Arnon Amir/Almaden/IBM, Gal Ashour/Almaden/IBM

Inventor Name (> denotes primary contact)	Inventor Serial	Div/Dept	Manager Serial	Manager Name
> Amir, Arnon	785164	22/K57D	020433	Petkovic, Dragutin
Ashour, Gal	3A6114	22/K57D	020433	Petkovic, Dragutin

Inventors without Lotus Notes IDs

IDT Selection

IDT Team:	Attorney/Patent Professional:
Alison Mortinger/Almaden/IBM Susana Delgado/Almaden/IBM	Alison Mortinger/Almaden/IBM

Response Due to IP&L : 05/05/2000

Main Idea

***Title of disclosure (in English)**

Automatic Gain Control of Audio Level by Speaker Motion Analysis

***Idea of disclosure**

1. Describe your invention, stating the problem solved (if appropriate), and indicating the advantages of using the invention.

The present innovation is in the field of video and audio processing.
It concerns with undesired variation of recorded audio level of speech
due to speaker motion and speaker head rotation. It presents a method

to automatically compensate for these changes in the recorder audio level by examining the speaker movement in the video, detecting his relative position and head rotation, and compensating for the audio level accordingly.

The invention applies to many fields where audio is being transferred by microphones, such as teleconferencing and video conference, lecture videotaping, distance learning, remote education and training, to cellular and other mobile phones and communication devices, music and sound recording, radio, television and other media. In all these fields speech is captured by microphones and so they could leverage from a "smart" microphone that its sensitivity is adaptive to the speaker motion.

2. How does the invention solve the problem or achieve an advantage,(a description of "the invention", including figures inline as appropriate)?
When a speaker or lecturer is recorded, a microphone is used to receive the voice audio signal into a recording device. The microphone is typically fixed on a stage, wired to the speaker clothes, or held by hand. When the speaker is moving, walking, leaning or rotating his head, the distance and direction to the microphone changes, and therefor the received audio level varies.
The recorded audio level gets higher as the microphone gets closer to the speaker mouth. Similarly, when the head is directed away from the microphone, the audio level decreases. These changes result in quality degradation of recorded audio, and have direct impact on the quality of audio and video playback, on audio analysis (e.g., speech recognition) etc. The process described hereon measures the speaker physical position and uses it to compensate for the undesired changes in audio level by changing the audio gain accordingly.

It is important to note that changes in audio level happened not only due to changes in the speaker physical position but also due to intentional and unintentional speech changes by the speaker (e.g., to emphasis a certain sentence), due to language switching, different speakers etc. Therefor, changing the audio gain to make the audio level constant will distort the original, will cause the loss of information embedded in the intended speech level change, and hence is undesired. The purpose of the present innovation is to isolate the amount of audio level change which corresponds to the limitation of the recording microphone arrangement and reduce or eliminate it.

An audio stream is a machine readable audio signal which contains speech by a speaker. A video input comprise of a machine readable moving pictures signal in which the speaker is shown, in part or in whole.
Given an audio stream and a video stream, the proposed process changes the audio level using a process comprise of the following parts:

1. means of audio and video input
2. means of audio output
3. means of detecting the speaker physical position in the moving images.
4. means of determining the audio gain according to the detected motion
5. means of changing the audio gain between audio input and output

Clearly, other mapping functions can be used.

In yet another embodiment the audio can be an analogue electronic signal, and the audio gain control can be done by changing the gain of an analogue audio amplifier, by changing an audio attenuator, or by other means of audio level control.

In yet another embodiment the audio can be an acoustic wave signal, propagating in a pipe filled of gas. The audio level can be controlled by acoustic attenuator.

The process can be applied to recorded and stored audio and video streams, as well as to live streams, while the lecture is taking place.

In another embodiment the mapping between speaker physical position and audio gain can be automatically determined from the audio and video signals. In one such example, the processing of recorded and stored audio and video signals is break into three steps. In the first step, part of the video and audio signals are analyzed, the audio level of the input signal is measured, as well as the physical speaker position. These measures are temporary stored in memory or other storage means. Then, the relationship between the measured speaker physical position and the measured audio level is explored, and a mapping between the two is determined. This mapping then replace the fixed mapping described above, e.g., in Figure 2. In the third step, this mapping is used to control the audio gain.

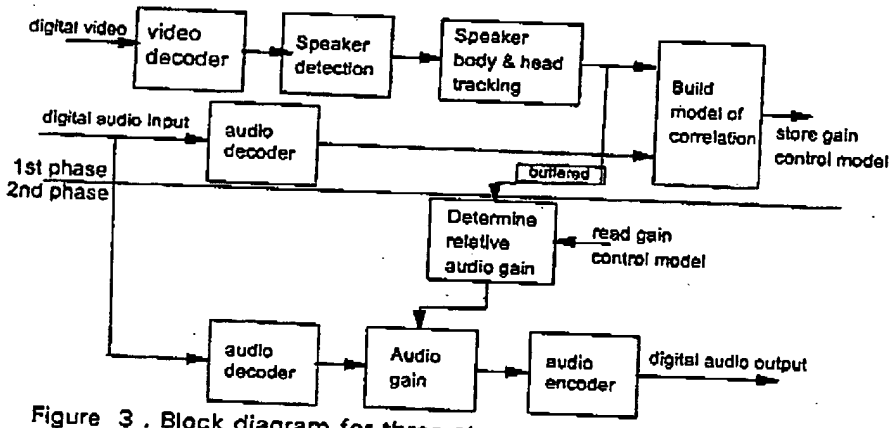

Figure 3 . Block diagram for three stages processing

The speaker physical position can be measured in various different ways. Although the above discussion uses video signal for measuring it, there are many other ways in which this measure can be done, including motion, orientation and positioning sensors wired to the speaker [Media-lab], three dimensional mapping by laser range finder [laser], structured light [structured-light], etc. These signals can be either measured and used for audio gain control during the talk, or recorded with time stamps and used later on for that purpose. It is clear that the invention does not depend on the way in which the physical speaker position is measured.